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IS 9638-1 (1980): Fixed Polyester Film Dielectric Capacitors for Direct Current, Part 1: General Requirements and Methods of Tests [LITD 5: Semiconductor and Other Electronic Components and Devices]



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“Knowledge is such a treasure which cannot be stolen”

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IS : 9638 (Part I) - 1980
(Reaffirmed 2002)

Indian Standard

**SPECIFICATION FOR
FIXED POLYESTER FILM DIELECTRIC
CAPACITORS FOR DIRECT CURRENT**

**PART I GENERAL REQUIREMENTS AND
METHODS OF TESTS**

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SPECIFICATION FOR FIXED POLYESTER FILM DIELECTRIC CAPACITORS FOR DIRECT CURRENT

PART I GENERAL REQUIREMENTS AND METHODS OF TESTS

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Indian Standard

SPECIFICATION FOR FIXED POLYESTER FILM DIELECTRIC CAPACITORS FOR DIRECT CURRENT

PART I GENERAL REQUIREMENTS AND METHODS OF TESTS

0. FOREWORD

0.1 This Indian Standard (Part I) was adopted by the Indian Standards Institution on 24 September 1980, after the draft finalized by the Capacitors Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

0.2 The object of this Indian Standard (Part I) is to establish uniform requirements for judging the mechanical, electrical and climatic properties of fixed polyester film dielectric and similar dielectric direct current capacitors, for rated voltage not exceeding 6 300 V, and using electrodes of thin metal foils, intended to be used in electronic and telecommunication equipment.

0.3 This standard requires reference to IS : 7305 (Part I)-1973* in which details of various tests prescribed have been fully covered. Only the appropriate degrees of severity and any other special conditions relating to certain tests have been included in this standard.

0.4 This standard does not cover capacitors for radio interference suppression which are covered by IS : 3723 (Part I)-1978†.

0.5 While preparing this standard, assistance has been derived from the following:

- a) IEC Document 40 (Central Office) 417: Draft Sectional Specification for Fixed Polyethylene-terephthalate Film Dielectric Metal Foil Capacitors for Direct Current; Selection of Methods of Tests and General Requirements. The International Electro-technical Commission (IEC).

*Fixed capacitors used in electronic equipment: Part I General requirements and tests.

†Capacitors for radio interference suppression: Part I General requirements and methods of tests (*first revision*).

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b) JSS : 50212 (1972) : Detail Specification for Capacitors, Fixed, Paper/Polyester Dielectric. The Ministry of Defence, India.

1. SCOPE

1.1 This standard relates to fixed polyester film dielectric and similar dielectric direct current capacitors, for rated voltages not exceeding 6 300 V, and using electrodes of thin metal foils intended for use in electronic equipment. For capacitors with rated voltages exceeding 1 000 V, additional tests and requirements may be specified in the detail specification.

2. TERMINOLOGY

2.1 In addition to the terms and definitions specified in IS : 7305 (Part I)-1973*, the following definition shall apply.

2.2 Rated Voltage U_R — The rated voltage is the maximum dc voltage which may be applied continuously to the terminals of a capacitor at the rated temperature.

NOTE 1 — The sum of the dc voltage and the peak ac voltage to be applied to the capacitor shall not exceed the rated voltage.

NOTE 2 — The value of the peak ac voltage shall not exceed the following percentages of the rated voltage at the frequencies stated and shall be maximum 280 V:

50 Hz	20 percent
100 Hz	15 percent
1 000 Hz	3 percent
10 000 Hz	1 percent

unless otherwise specified in the detail specification.

3. DESCRIPTION AND CODE

3.1 The description of the type of the capacitor may be in the form of a four character code.

Example : FCPE

FC : Fixed capacitor

PE : Polyester

*Fixed capacitors used in electronic equipment: Part I General requirements and tests.

4. CLIMATIC CATEGORIES

4.1 The severities for the cold, dry heat and damp heat (steady state) tests for the capacitors covered by this standard shall be preferably within the following ranges:

Lower category temperature	— 10°C to — 65°C
Upper category temperature	+ 70°C to + 125°C
Damp heat (steady state)	04 to 56 days

Values selected within these ranges shall be chosen from those listed in IS : 9000 (Part I)-1977*. The severities for the cold and dry heat tests are the lower and upper category temperatures respectively.

4.2 The preferred climatic categories are:

Climatic Test	Severities			
	Category 1		Category 2	Category 3
	1A	1B		
Dry heat	+ 125°C	+ 100°C	+ 85°C	+ 70°C
Cold	— 65°C	— 55°C	— 40°C	— 10°C
Damp heat (long term)	56 days	56 days	21 days	21 days
Damp heat (accelerated)	6 cycles	6 cycles	2 cycles	2 cycles
Rapid change of tempera- ture	+ 125°C to — 65°C	+ 100°C to — 55°C	+ 85°C to — 40°C	Not appli- cable
Low air pressure	1.1 kPa	4.4 kPa	8.5 kPa	60 kPa

NOTE — In case of special requirements when the above categories cannot be applied strictly, other combinations of severities may be agreed to between the purchaser and the manufacturer provided such severities are chosen from IS : 9000 (Part I)-1977*.

*Basic environmental testing procedures for electronic and electrical items : Part I General.

5. RATINGS

5.1 Rated Capacitance — Preferred values of rated capacitance (C_R) are:

1, 1.5, 2.2, 3.3, 4.7, and 6.8 and their decimal multiples

These values conform with the E6 series of preferred values. If other values are required they shall be chosen from the E12 and E24 series.

5.2 Tolerance on Rated Capacitance — The preferred tolerances on the rated capacitance are ± 2 percent, ± 5 percent, ± 10 percent and ± 20 percent.

5.3 Rated Voltage (U_R) — The preferred values of rated voltage are : 63, 100, 160, 250, 400 V and their decimal multiples. These values conform to the R5 series of preferred values.

5.4 Category Voltage (U_C) — The category voltage is :

0.8 U_R for category temperature $+ 100^\circ\text{C}$, and

0.5 U_R for upper category temperature $+ 125^\circ\text{C}$.

The derating curve if necessary would be given in the relevant detail specification.

5.5 Rated Temperature — The standard value of rated temperature is 85°C or 70°C as applicable.

6. CONSTRUCTION AND WORKMANSHIP

6.1 Provisions of 5 of IS : 7305 (Part I)-1973* shall apply.

7. MARKING

7.1 The information given in the marking is normally selected from the following list. The relative importance of each item is indicated by its position in the list:

a) Rated capacitance;

NOTE — When values and tolerances are coded one of the methods specified in IS : 8186-1976† shall apply.

b) Rated voltage : dc voltage may be indicated by the symbol ---
or --- .

*Fixed capacitors used in electronic equipment: Part I General requirements and tests.

†Marking codes for values and tolerances of resistors and capacitors.

- c) Tolerance on rated capacitance [*see* Note under (a)];
- d) Style reference;
- e) Year and month (or week) of manufacture. This may be in code form [*see* Note under (a)];
- f) Manufacturer's name or trade-mark; and
- g) Climatic category.

7.2 The capacitor shall be clearly marked with (a), (b) and (c) above and with as many as possible of the remaining items as is considered useful. Any duplication of information in the marking on the capacitor shall be avoided.

7.3 The package containing the capacitor(s) shall be clearly marked with all the information at least as listed from (a) to (f) of **7.1**.

7.4 Any additional marking shall be so applied that no confusion can arise.

7.5 The capacitors may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act, and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard, under a well-defined system of inspection, testing and quality-control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions, under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

8. TESTS

8.1 Classification of Tests

8.1.1 Type Tests

8.1.1.1 Type approval procedure — The procedures for type approval shall be in accordance with IS : 2612-1965*.

8.1.1.2 Selection of samples — Samples shall, as far as possible, comprise equal quantities of the lowest and the highest capacitance values of the closest selection tolerance in each voltage rating.

NOTE — The approval of closest selection tolerance implies approval of all other higher tolerances in a particular voltage rating.

*Recommendation for type approval and sampling procedures for electronic components.

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8.1.1.3 Number of samples — Unless otherwise specified, the number of specimens shall be 30 in accordance with Table 1, in each voltage rating having minimum and maximum capacitance values.

NOTE — A capacitor subjected to type tests according to Table 1 shall not be used in equipment nor be returned to bulk supply.

TABLE 1 SCHEDULE OF TYPE TESTS

(Clause 8.1.1)

GROUP	NUMBER OF SPECIMENS FOR EACH VOLTAGE RATING		TEST	CLAUSE REFERENCE
	Lowest Capacitance	Highest Capacitance		
(1)	(2)	(3)	(4)	(5)
0	30	30	Visual examination	8.4.1
			Dimensions	8.4.2
			Capacitance	8.3.2
			Tangent of loss angle	8.3.3
			Outer foil marking	8.3.6
			Inductance	8.3.5
			Voltage proof	8.3.1
			Insulation resistance	8.3.4
			Sealing	8.9
1	6	6	Solderability	8.4.4.1
			Robustness of terminations	8.4.3
			Bump	8.4.6
			Vibration	8.4.5
			Shock	8.4.7
			Acceleration (steady state)	8.4.8
			Rapid change of temperature	8.5.3
			Climatic	8.5.1
2	6	6	Damp heat (long term)	8.5.2
			Dielectric absorption	8.3.7
			Storage at cold temperature	8.10
3	8	8	Endurance (electrical)	8.8
4	2	2	Mould growth	8.7
5	3	3	Resistance to solvents	8.4.9
			Resistance to soldering heat	8.4.4.2
			Resistance to steam (wher- ever applicable)	—
6	3	3	Salt mist	8.6
Spares	2	2		

8.1.1.4 Schedule of type tests — The capacitors shall be subjected to the tests according to Table 1 and in the order given. After the completion of the tests specified under group 0, the samples shall be divided into six groups for further testing.

8.1.2 Routine Tests — The following shall constitute the routine tests:

- a) Visual examination,
- b) Voltage proof (as a flash test), and
- c) Capacitance.

8.1.3 Acceptance Tests — For the purpose of acceptance of the lot, the capacitors shall be subjected to the tests as specified in 8.1.2. Following this, two group of samples (Group A and B) shall be selected and the capacitors in each group shall be subjected to the tests specified in Table 2 in the order given.

TABLE 2 SCHEDULE OF ACCEPTANCE TESTS

TEST	CLAUSe REFERENCE	AQI (PERCENT DEFECTIVE)	INSPECTION LEVEL	D/ND
(1)	(2)	(3)	(4)	(5)
GROUP A				
Dimensions	8.4.2	1	II	ND
Tangent of loss angle	8.3.3			
Outer foil marking	8.3.6			
Insulation resistance	8.3.4			
Sealing	8.9			
GROUP B				
Sub-group B 1		4	S3	D
Solderability	8.4.4.1			
Robustness of terminations	8.4.3			
Bump	8.4.6			
Climatic	8.5.1			
Sub-group B 2		4	S3	ND
Endurance (electrical) (163 hour)	8.8			
Sub-group B 3				
Resistance to solvent	Six samples (2 for each solvent)			
ND — Non-destructive. D — Destructive.				

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8.2 General Conditions for Tests — The general conditions for tests shall be as specified in 7.2 of IS : 7305 (Part I)-1973*. The error of the measurement shall not exceed 10 percent.

8.3 Electrical Tests

8.3.1 Voltage Proof — The test shall be carried in accordance with 7.3.1 of IS : 7305 (Part I)-1973*, with the following details.

8.3.1.1 Test circuit — The product of R_1 and the capacitance ($C_x + C_1$) shall be less than or equal to 1 second and greater than 0.01 second. R_1 includes the internal resistance of the power supply. R_2 shall limit the discharge current to smaller than or equal to 1 A, or the power value prescribed in the detail specification.

8.3.1.2 The following voltages shall be applied for a period of 1 minute between the measuring points of Table 1 in 7.3.1.8 of IS : 7305 (Part I)-1973* for type tests and maximum 2 s for other tests:

<i>Test Point</i>	<i>Test Voltage</i>
1 A	$2 U_R$
1 B, 1 C	$2 U_R$ with a minimum of 400 V

8.3.2 Capacitance — This test shall be carried out in accordance with 7.3.2 of IS : 7305 (Part I)-1973*.

8.3.2.1 The capacitance shall be measured at a frequency of 1 000 Hz. For capacitors whose values are greater than 1 Mfd and rated voltage up to 3 kV the measuring frequency should be 50 Hz or 100 Hz. But for capacitors whose values are less than 1 Mfd and rated voltage of 3 kV or more, the measuring frequency shall be 1 kHz. The applied peak voltage at 1 000 Hz shall not exceed 3 percent of the rated voltage and the applied peak voltage at 50 to 100 Hz shall not exceed 15 percent of the rated voltage with a maximum of 100 V (70 V rms).

8.3.2.2 The capacitance shall be within the specified tolerance.

8.3.3 Tangent of Loss Angle — This test shall be carried out in accordance with 7.3.3 of IS : 7305 (Part I)-1973* with the following details.

8.3.3.1 Measuring conditions — $\tan \delta$ shall be measured and the value shall be noted (for reference purpose). The measuring frequency and applied peak voltage shall be the same as used for the capacitance measurement in 8.3.2.1.

*Fixed capacitors used in electronic equipment: Part I General requirements and tests.

8.3.3.2 Requirement — $\tan \delta$ shall not exceed the following:

60×10^{-4} for category 1

100×10^{-4} for category 2 and 3

8.3.4 Insulation Resistance — This test shall be carried out in accordance with 7.3.6 of IS : 7305 (Part I)-1973* with the following details.

8.3.4.1 Before the measurement, the capacitor shall be fully discharged. The product of the resistance of the discharge circuit and the rated capacitance of the capacitor under test shall be ≥ 0.01 unless otherwise prescribed in the detail specification.

8.3.4.2 The measuring voltage shall be in accordance with 7.3.6.2 of IS : 7305 (Part I)-1973*. The voltage shall be applied immediately at the correct value through the internal resistance of the voltage source. The product of the internal resistance and the rated capacitance of the capacitor shall be smaller than 1 s unless otherwise prescribed in the detail specification.

8.3.4.3 Requirement — The insulation resistance shall meet the requirements as specified in the relevant detail specification.

8.3.3.4 Where the test is carried out at a temperature other than 25°C, the result shall, where necessary, be corrected to 25°C by multiplying the result of the measurement by the appropriate correction factor. In case of doubt, measurement at 25°C is decisive. The following correction factor can be considered as an average:

<i>Temperature (°C)</i>	<i>Correction Factor</i>
15	0.63
16	0.66
17	0.69
18	0.72
19	0.76
20	0.80
21	0.83
22	0.87
23	0.91
24	0.95
25	1.00
26	1.05

*Fixed capacitors used in electronic equipment : Part I General requirements tests.

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<i>Temperature (°C)</i>	<i>Correction Factor</i>
27	1.10
28	1.15
29	1.20
30	1.26
31	1.32
32	1.38
33	1.45
34	1.52
35	1.59

The above values are based upon the formula:

$$R_{25} = R_t \times 2 \left(\frac{t - 25}{15} \right)$$

where

R_{25} = insulation resistance at 25°C, and

R_t = insulation resistance at temperature t °C.

8.3.5 Inductance — This test shall be carried out in accordance with 7.3.7 of IS: 7305 (Part I)-1973*. The inductance value shall be as specified in the detail specification.

8.3.6 Outer Foil Marking — This shall be carried out in accordance with 7.3.9 of IS: 7305 (Part I)-1973*.

8.3.7 Dielectric Absorption — Unless otherwise specified, the capacitor shall be charge at the dc voltage rating for 1 hour $\pm$ 1 minute. The initial surge current shall not exceed 50 mA. At the end of this period, the capacitor shall be disconnected from the power source and discharged through a 5 ohm $\pm$ 5 percent resistor for 10 $\pm$ 1 seconds. The discharged resistor shall be disconnected from the capacitor at the end of the 10-second discharge period, and the voltage remaining on the capacitor (recovery voltage) shall be measured with an electrometer or other suitable device having an input resistance of 10 000 M Ω or greater. Recovery voltage shall be read at the maximum voltage within a 15 minutes period. The dielectric absorption shall be computed from the following formula:

$$d = \frac{V_1}{V_2} \times 100$$

*Fixed capacitors used in electronic equipment: Part I General requirements and tests.

where

d = percentage dielectric absorption,

V_1 = maximum recovery voltage, and

V_2 = charging voltage.

8.4 Physical and Mechanical Tests

8.4.1 Visual Examination — The capacitors shall be visually examined for the requirements of marking and finish.

8.4.2 Dimensions — The dimensions shall be checked for compliance with those specified in the relevant specification.

8.4.3 Robustness of Terminations — This test shall be carried out in accordance with 7.4.3 of IS : 7305 (Part I)-1973*.

8.4.4 Soldering

8.4.4.1 Solderability — Unless otherwise prescribed in the detail specification, the capacitors shall be subjected to this test in accordance with 7.4.4 of IS : 7305 (Part I)-1973* using either the solder globule method or the solder bath method, with the following deviations:

- The wire terminations stated by the manufacturer to be suitable for use with printed wiring shall be immersed up to $2 \begin{smallmatrix} +0.5 \\ -0.0 \end{smallmatrix}$ mm from the body with a suitable heat shield, which will simulate a printed wiring board;
- The requirements for the solder globule method shall be prescribed in the detail specification; and
- Where neither the solder bath nor the solder globule method is appropriate, the soldering iron test shall be used with soldering iron size A.

NOTE — The thermal shock test is not applicable.

8.4.4.2 Resistance to soldering heat — Unless otherwise specified this test shall be carried out in accordance with Sec 3 of IS : 9000 (Part XVIII)† without any predrying.

Depth of immersion — The distance between the point emergence of the terminations and the capacitor body shall be $2.0 \begin{smallmatrix} +0.5 \\ -0.0 \end{smallmatrix}$ mm for Method 1A and 6.0 ± 0.6 mm for Method 1B.

*Fixed capacitors used in electronic equipment: Part I General requirements and tests.

†Basic environmental testing procedures for electronic and electrical items: Part XVIII Solderability test, Sec 3 Resistance to soldering heat test (*Under preparation*).

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8.4.4.3 *Final inspection, measurements and requirements* — Recovery—1 to 2 h. The capacitors mentioned shall be inspected and measured and shall meet the requirements as specified in the detail specification.

8.4.5 *Vibration* — This test shall be carried out in accordance with **7.4.5** of IS : 7305 (Part I)-1973* with the following details.

8.4.5.1 No initial measurements have to be made.

8.4.5.2 The severity shall be as specified in the relevant specification chosen from the following:

Frequency Hz	Peak Value of Vibration Amplitude ± 10 percent	Duration	Climatic Category (see 4.2)
10 to 2 000	0.75 mm or 200 m/s ² whichever is less	12 hours	1A
10 to 2 000	0.75 mm or 100 m/s ² whichever is less	9 hours	1B
10 to 500	0.75 mm or 100 m/s ² whichever is less	6 hours	2 & 3

8.4.5.3 Where specified in the detail specification, when capacitors are tested as specified, there shall be no intermittent contacts of greater than or equal to 0.5 ms, nor open or short circuit and no visible damage.

After the test, the capacitors shall be visually examined and there shall be no damage. Capacitance, $\tan \delta$ and insulation resistance shall be measured and the values shall not exceed the limits specified in the relevant detail specification.

8.4.6 *Bump* — This test shall be carried out in accordance with **7.4.7** of IS : 7305 (Part I)-1973* with the following details.

8.4.6.1 No initial measurements have to be made. The severity shall be 4 000 bumps for category 1 and 2 and 1 000 bumps for category 3.

8.4.6.2 *Final inspection, measurements and requirements* — The capacitors shall be inspected and measured and shall meet the requirements as follows:

- There shall be no visible damage; and
- The change of capacitance, $\tan \delta$ and insulation resistance shall be measured. The values shall not exceed the limits specified in the relevant detail specification.

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8.4.7 Shock — This test shall be carried out in accordance with **7.4.8** of IS : 7305 (Part I)-1973* with the following details.

8.4.7.1 No initial measurements have to be made. The severity shall be 1 km/s^2 for category 1 and 2. This test is not applicable to category 3.

8.4.7.2 Final inspection, measurements and requirements — The capacitors shall be inspected and measured and shall meet the following requirements:

There shall be no visible damage. Capacitance, $\tan \delta$ and insulation resistance shall be measured and the values shall not exceed the limits prescribed in the detail specification.

8.4.8 Acceleration — This test shall be carried out in accordance with **7.4.9** of IS : 7305 (Part I)-1973*.

The degree of severity shall be 1 km/s^2 for category 1 and 2. This test is not applicable for category 3.

After the test, the capacitors shall be visually examined. There shall be no damage. Capacitance, $\tan \delta$ and insulation resistance shall be measured and the limits shall be specified in the relevant detail specification.

8.4.9 Resistance to Solvents — This test shall be carried out in accordance with IS : 9000 (Part XX)-1979†. This test shall not be applicable to category 3.

8.5 Climatic Test

8.5.1 Climatic Sequence — This test shall be carried out in accordance with **7.5.1** of IS : 7305 (Part I)-1973* with the following details.

8.5.1.1 Initial measurements — No initial measurements have to be made.

*Fixed capacitors used in electronic equipment: Part I General requirements and tests.

†Basic environmental testing procedures for electronic and electrical items: Part XX Resistance to cleaning solvents and permanence of markings.

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8.5.1.2 Dry heat — This test shall be carried out in accordance with **7.5.1.2** of IS : 7305 (Part I)-1973* with the following details:

- a) Duration : 16 h;
- b) While still at the high temperature and at the end of the period of high temperature, the capacitance shall be measured. When required by the detail specification the insulation resistance shall be measured and the value shall not exceed that specified;
- c) The percentage difference between the capacitance measured at the high temperature and in **8.4.8** shall meet the requirements specified in detail specification; and
- d) The capacitance measurements are not required for category 3 capacitors.

8.5.1.3 Damp heat (accelerated) first cycle — This test shall be carried out in accordance with **7.5.1.3** of IS : 7305 (Part I)-1973* with the rated voltage applied.

After recovery the capacitors shall be visually examined. There shall be no visible damage and marking shall be legible.

8.5.1.4 Cold — This test shall be carried out in accordance with **7.5.1.4** of IS : 7305 (Part I)-1973* with the following details:

- a) Duration : 2 h;
- b) Prior to the test, the capacitance shall be measured under standard atmospheric conditions for testing;
- c) While still at the specified low temperature and at the end of the period of low temperature, the capacitance shall be measured. The percentage difference between the capacitances measured here and in (b) shall meet the requirements specified in detail specification; and
- d) Capacitance measurement at cold temperature is not required for category 3 capacitors.

8.5.1.5 Low air pressure — This test shall be carried out in accordance with **7.5.1.5** of IS : 7305 (Part I)-1973* with the following details:

- a) The test shall be made when required by the detail specification. A temperature of 15°C to 35°C and a pressure as applicable to the category shall be used. The duration of the test shall be 5 minutes.

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- b) While still at the specified low pressure (*see* 4.2) and during the five minutes of the test, the rated voltage shall be applied for the test minute. The sample part of capacitors submitted to this test shall be subdivided into two or three parts as necessary and each part submitted to one of the tests laid down under A and B in Table 1 or 7.3.1.8 of IS : 7305 (Part I)-1973*. The test voltage shall be applied to terminations, case, etc, as given in 8.3.1.2.
- c) During and after the test there shall be no evidence of permanent breakdown, flashover, or harmful deformation of the case.

8.5.1.6 Damp heat (accelerated) remaining cycles — This test shall be carried out in accordance with 7.5.1.6 of IS : 7305 (Part I)-1973* with the following details:

Within 15 minutes after removal from the damp heat test, the rated voltage shall be applied for five minutes at test point A using the test circuit conditions given in 8.3.1.

8.5.1.7 Final inspection, measurements and requirements — After recovery the capacitors shall be inspected and measured for following parameters and shall meet the requirements specified in the detail specification:

Visual examination	<i>See</i> 8.4.1
Voltage proof	<i>See</i> 8.3.1
Capacitance	<i>See</i> 8.3.2
Tan δ	<i>See</i> 8.3.3.1
Insulation resistance	<i>See</i> 8.3.4

8.5.2 Damp Heat (Steady State) — This test shall be carried out in accordance with 7.5.2 of IS : 7305 (Part I)-1973* with the following details:

8.5.2.1 Initial measurement — No initial measurements have to be made.

8.5.2.2 The intermediate measurements shall be as given below:

- a) Throughout the period of exposure, one half of the specimens shall have the rated voltage applied between the terminations, and
- b) Within 15 minutes after removal from the chamber the remaining specimen shall have the rate voltage applied between the terminations for five minutes.

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8.5.2.3 Final inspection, measurements and requirements — Within 1-2 hours after recovery, the capacitors shall be inspected and measured for following parameters and shall meet the requirements as specified in detail specifications:

Voltage proof at $2 \times U_R$	See 8.3.1
Visual examination	See 8.4.1
Capacitance	See 8.3.2
Tan δ	See 8.3.3.1
Insulation resistance	See 8.3.4

8.5.3 Rapid Change of Temperature — This test shall be carried out in accordance with **7.5.3** of IS : 7305 (Part 1)-1973*.

Number of cycles — 5

Duration of exposure at the temperature limits — 30 minutes or longer if specified in the detail specification.

The capacitance, tan δ and insulation resistance shall be measured. The change of capacitance compared with the values measured in **8.3.2** shall not exceed ± 5 percent. The tan δ and insulation resistance shall not exceed those specified in the detail specification.

8.6 Salt Mist — This test shall be carried out in accordance with **7.5.5** of IS : 7305 (Part I)-1973*. The duration of the exposure shall be 4 days.

Capacitors shall be visually examined. There shall be no damage, including corrosion. Marking shall be legible.

Final measurements of voltage proof and insulation resistance shall be measured for category 1-2 only.

8.7 Mould Growth — This test shall be carried out in accordance with **7.5.4** of IS : 7305 (Part I)-1973*.

There shall be no mould growth, visible to naked eye. This test shall not be applicable for category 3.

8.8 Endurance — This test shall be carried out in accordance with **7.9** of IS : 7305 (Part I)-1973* with the following details.

8.8.1 Initial Measurement — No initial measurements have to be made.

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8.8.2 The duration of the test shall be 2 000 hours for category 1 and 1 000 hours for categories 2 and 3 unless otherwise stated.

8.8.3 Test Voltage and Temperature — For categories 1A and 1B, half of the samples shall be subjected to rated temperature at the rated voltage and the other half shall be subjected to the upper category temperature at the appropriate derated voltage. For categories 2 and 3, all samples are subjected to the rated voltage at the rated temperature. The test voltage shall be applied to the capacitors individually through a resistor whose value is approximately equal to 1 per applied voltage.

8.8.4 Final Inspection Measurements and Requirements — The capacitors shall be inspected and measured for following parameters and shall meet the requirements as specified in detail specification:

Visual examination	See 8.4.1
Voltage proof	See 8.3.1
Capacitance	See 8.3.2
Tan δ	See 8.3.3.1
Insulation resistance	See 8.3.4

8.9 Sealing (for Hermetically Sealed Types Only) — This test shall be carried out in accordance with 7.5.6 of IS : 7305 (Part I)-1973*.

8.10 Storage at Cold Temperature — The storage at cold temperature shall be in accordance with IS : 7305 (Part I)-1973* for categories 1 and 2. This test shall not be applicable to category 3. After final measurements, capacitors shall be visually examined and variation of capacitance shall be measured.

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INDIAN STANDARDS
ON
CAPACITORS

IS :

- 590-1964 Fixed paper dielectric capacitors for dc (*revised*)
- 824-1965 Preferred values for resistors and capacitors
- 1885 (Part XLV)-1977 Electrotechnical vocabulary : Part XLV capacitors
- 2001-1968 Fixed silvered mica capacitors (*first revision*)
- 2786 (Part I)-1978 Ceramic dielectric capacitors, Type 2 : Part I General requirements and methods of tests (*first revision*)
- 3671 (Part I)-1966 Air dielectric variable tuning capacitors : Part I Tests and general requirements (*first revision*)
- 3723 (Part I)-1978 Capacitors for radio interference suppression : Part I General requirements and methods of tests (*first revision*)
- 4317 (Part I)-1977 Aluminium electrolytic capacitors with non-solid electrolyte : Part I General requirements and tests (*first revision*)
- 4633-1968 Fixed metallized-paper dielectric capacitors for direct current
- 5361-1969 Polyester film dielectric capacitors for direct current
- 5475 (Part I)-1978 Polystyrene film dielectric capacitors: Part I General requirements and methods of tests (*first revision*)
- 7305 (Part I)-1973 Fixed capacitors used in electronic equipment : Part I General requirements and tests
- 7305 (Part II)-1975 Fixed capacitors used in electronic equipment : Part II Ceramic dielectric capacitors, Type I (*Superseding* IS : 1980-1967)
- 7748 (Part I)-1975 Variable capacitors : Part I Tests and general requirements
- 8083-1976 Dimensions of ceramic dielectric capacitors of the plate type
- 8186-1976 Marking codes for values and tolerances of resistors and capacitors (*Superseding* IS : 825-1956 and IS 4114-1967)
- 8238-1976 Guide for use of variable capacitors in electronic equipment
- 8507 (Part I)-1977 Fixed tantalum capacitors with solid electrolyte : Part I General requirements and methods of test
- 9256 Fixed metallized polyester film dielectric capacitors:
 - 9256 (Part I)-1979 General requirements and methods of tests
 - 9256 (Part II)-1979 Type FCPM 1
 - 9256 (Part III)-1979 Type FCPM 2
- 9638-1980 Fixed polyester film dielectric capacitors for direct current : Part I General requirements and methods of tests